

REMARKS

Applicants note that the Examiner has acknowledged receipt of applicants' Formal Drawings which were filed by U.S. Express Mail on April 1, 2002. However, the Examiner has not indicated whether these drawings are accepted or are objected to by the Examiner. Applicants would appreciate an indication as to whether any corrections are required so that such corrections can be made and submitted immediately if necessary.

Applicants hereby confirm the provisional election of Claims 22 - 43, drawn to a ceramic product, for continued prosecution. This provisional application was made during a telephone conversation between Examiner McDonald and the undersigned attorney of record on November 21, 2003. However, applicants do not agree as to the reasons the Examiner provided as to why a restriction was proper. Applicants are of the opinion that the record needs to be corrected with respect to this matter.

The Examiner has submitted that "In the instant case the process as claimed can be used to make other and materially different product such as a component for a ceramic processing chamber that uses heat treatment instead of physical vapor deposition". Applicants' attorney is concerned that the Examiner may be confusing a ceramic component which has particular physical properties with a use of a ceramic component having those physical properties in a processing apparatus application. A ceramic component having particular physical properties may be distinguishable from a method which was used to make the ceramic component. However, once the ceramic component has particular physical properties, those physical properties may make the component useful in a number of different end use applications, which one skilled in the semiconductor processing arts would recognize based on the environment to which the component is to be exposed. Applicants' attorney is of the opinion that the restriction requirement should have been based on a distinction between the ceramic component having particular physical properties and a method of making a component (where the method may be used to make other articles of manufacture which are distinctly different from the semiconductor

apparatus components of applicants' invention. Applicants' Claims 22 - 32 as originally filed pertain to a component for use within a semiconductor processing chamber, wherein the component has at least one ceramic surface which has mechanical interlocks formed therein. Applicants' Claims 33 - 43 as originally filed pertain to a deposition ring which is a preferred embodiment of the component for use in a semiconductor processing chamber.

Claim Rejections Under 35 USC § 102

Claims 22 and 23 are rejected under 35 USC § 102(e) as being anticipated by U.S. Patent No. 6,620,520, to O'Donnell et al. Although applicants are of the opinion that their invention is distinguishable over the disclosure in the O'Donnell et al. reference, applicants hereby reserve the right to swear behind the date of the O'Donnell et al. reference.

Applicants respectfully contend that the disclosure in the O'Donnell et al. reference does not anticipate (or make obvious) applicants' invention as claimed in amended Claims 22 and 23. The O'Donnell et al. reference describes a component where a ceramic coating is applied over the surface of an underlying substrate, to protect the underlying substrate from a corrosive environment. A reading of Col. 5, lines 17 - 59, indicates that the underlying substrate is commonly an aluminum substrate over which a ceramic coating is applied. The aluminum substrate is cleaned and grit or bead blasted to provide a more chemically and physically active surface for bonding of a coating applied over the aluminum. (Col. 5, lines 1 - 15). The O'Donnell et al. reference also mentions that various ceramic or polymeric materials may also be coated with a protective ceramic material. (Col. 7, lines 52 - 55.) There is no alternative method described for the roughening of a ceramic surface which is different from the method recommended for the roughening of an aluminum surface (the grit or bead blasting method). In applicants' "Brief Description of the Background Art", at Page 3, lines 1 - 14, applicants explain that the state of the art prior to their invention provided for roughening of a ceramic surface by diamond tool grinding or by grit or bead blasting. Applicants explained that the use of either of these tech-

niques to roughen a ceramic surface reduces the tensile strength of the ceramic matrix and increases the brittleness of the ceramic, subjecting the ceramic material microcracking and to cohesive failure when a coating is applied over the ceramic surface, particularly when that coating is subsequently placed under tensile stress.

Applicants' invention is an improvement in the method of creating a ceramic surface to which a coating can adhere. Applicants' method creates a ceramic surface to which a coating can adhere, but in a manner such that microcracking of the ceramic structure is substantially reduced or avoided, so that cohesive failure of the ceramic structure under tensile stress is avoided.

Applicants' independent Claim 22 has been amended to recite that a component for use in a semiconductor processing chamber, which component includes at least one ceramic surface, includes mechanical interlocks present in the ceramic surface, where the mechanical interlocks are undercut into the ceramic surface using a process selected from the group consisting of pattern etching said ceramic surface through a mask using a chemical etchant, patterning etching said ceramic using a thermal etching process, and pattern etching said ceramic using a laser micromachining process which employs a laser system which includes optics for producing a patterned beam. All of these pattern etching processes are distinguishable from diamond tool grinding and from grit or bead blasting, and provide an improvement over these processes which were previously known in the art.

Claim 23 which depends from Claim 22 merely provides a listing of ceramic materials of the kind which may be roughened to provide the component of Claim 22.

In light of the above distinctions between applicants' claimed component as claimed in amended Claim 22, and the components prepared using the prior art ceramic roughening techniques, applicants respectfully request withdrawal of the rejection of Claims 22 and 23 under 35 USC § 102(e), over O'Donnell et al.

Claim Rejections Under 35 USC § 103

Claims 22, 23, and 25 - 32 are rejected under 35 USC § 103(a) as being unpatentable over O'Donnell et al.

The distinctions between applicants' component which includes a ceramic surface including patterned mechanical interlocks created by the specialized techniques disclosed by applicants, and a component of the kind described in the O'Donnell et al. disclosure is presented in detail above, with respect to the rejection of Claims 22 and 23 under 35 USC § 102(e). Claims 23 and 25 - 32 depend from Claim 22.

The Examiner has argued that it would have been obvious to use mechanical interlocks in the ceramic surface to increase the bonding strength of a coating applied subsequently over the ceramic surface. What is being overlooked is that any mechanical interlocks have to be created in a manner which does not create microcracking when the substrate is a ceramic. It is not just a matter of "roughening" a surface to create increased surface area as a means of providing improved bonding. Applicants have specifically addressed the problem of the creation of microcracks, which weakens the ceramic structure in a manner such that there may be cohesive failure in the ceramic structure. This leads to a separation of the overlying coating from the substrate, it is just that the failure is not at the interface between the coating and the substrate, it is within the substrate itself. The problem of creating microcracks in a ceramic substrate while trying to "roughen" the surface of the ceramic substrate is not discussed in any of the references cited by the Examiner. Applicants developed a gentle (relative to the prior art methods) method of creating an undercut, patterned, mechanically interlocking structure in a manner which did not introduce microcracking in the ceramic substrate. Applicants' ceramic components as claimed recite that the patterned mechanically interlocking structures are undercut into the ceramic substrate using a method selected from the methods which are known by applicants to substantially reduce or avoid the introduction of microcracking into the ceramic substrate.

In light of the above distinctions and the amendment to Claim 22, applicants respectfully request withdrawal of the rejection of Claims 22, 23, and 25 - 32 are rejected under 35 USC § 103(a) as being unpatentable over O'Donnell et al.

Claim 24 is rejected under 35 USC § 103(a) as being unpatentable over O'Donnell et al., as applied to Claims 22, 23, and 25 - 32, and further in view of U.S. Patent No. 5,558,789, to Singh.

The deficiencies of the disclosure of O'Donnell et al. with respect to the patentability of the presently claimed invention are discussed in detail above with respect to the rejection of Claims 22 and 23 under 35 USC § 102(e). Claim 24 has been cancelled without prejudice, as the features of Claim 24 have been incorporated into independent Claim 22. Therefore, applicants will address the present rejection as it applies to the amended Claim 22.

With respect to the issue of whether amended Claim 22, which now includes the recitations of Claim 24, would be obvious in view of a combination of the Singh reference in combination with the O'Donnell et al. reference, applicants contend that the combination of these references does not render their invention obvious. Claim 22 has been amended to recite that the interlocking structure is one which has been undercut into the ceramic substrate using a specialized method which is designed to prevent microcracking. Support for the additional recitation that the mechanical interlocking structure is one which is undercut is found throughout the description of the invention, for example at Page 7, line 27; at Page 8, lines 2, 6, and 7; at Page 9, line 5; at Page 13, lines 5 and 7; and at Page 15, line 5. Claim 25 which previously contained this recitation has been cancelled without prejudice.

The Singh reference pertains to a method of producing an improved adherent interface between a film or coating and a substrate of metal, ceramic, or composite material by laser treatment of the surface. The Singh laser technique employs a pulsed laser beam which is

scanned over the surface being treated (see Col. 1, line 67, through Col. 2, line 8, for example). The surface produced by the treatment is described at Col. 1, lines 65 - 67, continuing at Col. 2, lines 1 - 2, as being: “. . . structures in the form of cones, columns, peaks, fingers, grooves and valleys, probably due to preferential spatial absorption of the laser beam. The beam is scanned to induce change over as much of the surface as desired.” The focus in the Singh reference is on roughening of the surface using a technique which is dependent on the amount of laser spatial absorption occurring as a result of the composition of the surface being treated, to increase surface area (Col. 3, lines 15 - 18). By contrast, applicants' mechanical interlocks are created in a specific pattern over the ceramic surface.

In one embodiment of applicants' invention, the pattern on the ceramic surface is created using a laser micromachining process which employs a laser system which includes optics for producing a patterned beam. Singh does not teach or even suggest the use of a laser system which includes optics for producing a patterned beam to create mechanical interlocks in a ceramic surface. As mentioned above, the Singh structure produced is random, depending on spatial absorption of the laser beam, which depends on the ability of the surface to absorb the laser beam at any particular location. Further, the drawings and descriptions in the Singh reference do not teach the creation of a mechanical interlock by the creation of an undercut structure. There is no description or suggestion in the Singh reference of a component which can survive the corrosive environment present within a semiconductor processing chamber, where the component has at least one ceramic surface which has mechanical interlocks formed therein, where the mechanical interlocks are undercut into the ceramic surface using a process selected from the group consisting of pattern etching said ceramic surface through a mask using a chemical etchant, patterning etching said ceramic using a thermal etching process, and pattern etching said ceramic using a laser micromachining process which employs a laser system which includes optics for producing a patterned beam.

Not only is the Singh reference teaching for laser treatment to roughen a surface different from applicants' teaching of the use of a patterned laser beam to create patterned interlocks within a ceramic surface, but the Singh reference also fails to teach or even suggest the use of chemical etching or thermal etching to form mechanical interlocks in a ceramic surface, as disclosed and claimed by applicants.

Whether taken alone or in combination, neither O'Donnell et al. nor Singh teaches or even suggests applicants' invention as claimed in Claim 22.

In light of the above distinctions and the amendment to Claim 22, applicants respectfully request withdrawal of the rejection of Claim 24 under 35 USC § 103(a), over O'Donnell et al., and further in view of Singh.

Claims 33, 34, and 36 - 43 are rejected under 35 USC § 103(a) as being unpatentable over O'Donnell et al., in view of U.S. Patent No. 5,897,752, to Hong et al.

Claims 33, 34, and 36 - 43 pertain to a preferred embodiment of the component claimed in Claim 22, where the preferred embodiment component is a deposition ring used in a (semiconductor) physical vapor deposition chamber. Claim 33 has been amended in the same manner as discussed above with respect to Claim 22. The deficiencies of the disclosure of O'Donnell et al. with respect to the patentability of applicants' invention as claimed in Claim 33 are discussed in detail above with respect to the rejection of Claims 22 and 23 under 35 USC § 102(e).

The Hong et al. reference pertains to a plasma reactor for physical vapor deposition (PVD) which is adapted so that the atomic species sputtered from the target can self-sustain the plasma without the need for a working gas, such as argon. A bias ring arranged around the wafer and rising above it is electrically biased to control the plasma potential, and to control the energy and directionality of the ions being sputter deposited on the wafer. The bias ring can be either a separate biasing element, which can be positioned at a selected height above the wafer, or a

clamping ring clamping the wafer to the pedestal, but having a biasing surface electrically insulated from the wafer and the pedestal. (Abstract)

The Examiner cites Hong et al. as disclosing a clamp ring formed of an insulating ceramic with a metallic film on its top surface. This is one embodiment of the kind of component to which applicants' invention may be applied, to improve the performance of the component. The Hong et al. reference says nothing about the clamp ring having mechanical interlocks in the component ceramic surface to permit improved bonding of a metallic film applied over the surface of the ceramic. Applicants' invention, which is assigned to the assignee of the Hong et al. patent, provides an improvement over the art known and described at the time the Hong et al. application was filed. Applicants maintain that Claims 33, 34, and 36 - 43 are patentable over the combination of O'Donnell et al. and Hong et al. for the same reasons that applicants' independent Claim 22 is patentable over O'Donnell et al.

Whether taken alone or in combination, neither O'Donnell et al. nor Hong et al. teaches or even suggests applicants' claimed invention. In light of the above distinctions, applicants respectfully request withdrawal of the rejection of Claims 33, 34, and 36 - 43 under 35 USC § 103(a), over O'Donnell et al., and further in view of Hong et al.

Claim 35 is rejected under 35 USC § 103(a) as being unpatentable over O'Donnell et al., in view of Hong et al., as applied to Claims 33, 34, and 36 - 43, and further in view of Singh.

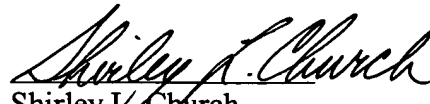
Claim 35 has been cancelled, since the recitations of this claim have been included in amended Claim 33, which is patentable over these references for the reasons provided above.

In view of the cancellation of Claim 35, the Examiner is respectfully requested to withdraw the rejection of Claim 35 under 35 USC § 103(a), over O'Donnell et al., in view of Hong et al., and further in view of Singh.

Applicants contend that all presently pending claims as amended are in condition for allowance, and the Examiner is respectfully requested to enter the present amendment and to pass the application to allowance.

The Examiner is invited to contact applicants' attorney with any questions or suggestions, at the telephone number provided below.

Respectfully Submitted,


Shirley L. Church
Registration No. 31,858
Attorney for Applicants
(650) 473-9700

Correspondence Address:
Patent Counsel
Applied Materials, Inc.
P.O. Box 450A
Santa Clara, CA 95052